



Improvements in Space Geodesy Data Discovery at the CDDIS

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Abstract: The Crustal Dynamics Data Information System (CDDIS) supports data archiving and distribution activities for the space geodesy and geodynamics community. The archive enables scientific research through access to GNSS, laser ranging, VLBI, and DORIS data sets and products derived from these data. The CDDIS is one of NASA's Earth Observing System Data and Information System (EOSDIS) distributed data centers; EOSDIS data centers serve a diverse user community and are tasked to provide facilities to search and access science data and products. The CDDIS data system and its archive are vital components to many national and international science communities, in particular NASA's Space Geodesy Project and several of the operational services within the International Association of Geodesy (IAG) and its project the Global Geodetic Observing System (GGOS), including the International DORIS Service (IDS), the International GNSS Service (IGS), the International Laser Ranging Service (ILRS), the International VLBI Service for Geodesy and Astrometry (IVS), and the International Earth Rotation and Reference Systems Service (IERS). Several activities are nearing completion at the CDDIS to aid users in data discovery, both within the international space geodesy community and beyond. This poster will include background information about the system and its user communities, archive contents and updates, enhancements for data discovery, new system architecture, and future plans.

Crustal Dynamics Data Information System

Background:

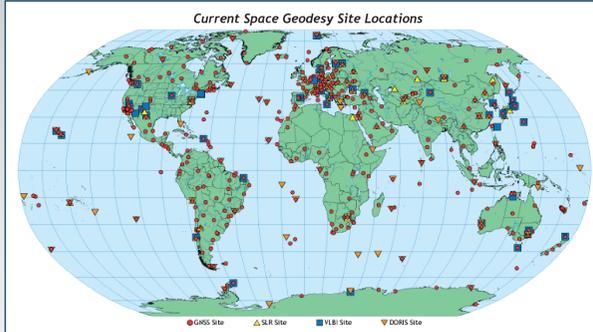
- The Crustal Dynamics Data Information System (CDDIS) is NASA's active archive of space geodesy data, products, and information (Global Navigation Satellite System/GNSS, Satellite Laser Ranging/SLR, Very Long Baseline Interferometry/VLBI, and Doppler Orbitography and Radio-positioning Integrated by Satellite/DORIS).
- The CDDIS is funded by NASA/ESDIS but cooperates extensively with the international community.
- The largest CDDIS user community comes from the services within the International Association of Geodesy (IAG).
- The contents of the CDDIS archive are utilized for geodetic studies, e.g., plate tectonics, earthquake displacements, Earth orientation, Earth's surface deformation, Earth's gravity field, etc.
- The CDDIS archive also plays an interdisciplinary role in supporting the derivation of a Terrestrial Reference Frame (the foundation for virtually all airborne, space-based and ground-based Earth observations), precise orbit determination (POD) for NASA/international missions, atmospheric studies, etc.

Archive Contents:

- Data:
 - Stations in the GNSS, SLR/LLR, VLBI, and DORIS networks generate point data on a multi-day, daily, hourly, and/or sub-hourly basis
 - GNSS: 500+ sites tracking GPS, GLONASS, and new GNSS (Galileo, QZSS, Beidou)
 - Laser Ranging (SLR and LLR): ~40 sites tracking 60+ satellites (including the Moon)
 - VLBI: 45 sites
 - DORIS: 58 sites tracking 5 satellites
- Products:
 - Precise network station positions (for ITRF)
 - Satellite orbits (for POD)
 - Station and satellite clocks (for timing)
 - Earth rotation parameters
 - Positions of celestial objects (for CRF)
 - Atmospheric parameters (ionosphere TEC, Troposphere ZPD) ...
- Metadata information:
 - Non-standard metadata, data type specific
 - Extracted from incoming files
 - Internal access to metadata database



All systems located at NASA Goddard Space Flight Center, Greenbelt MD



Archive Statistics:

- File size is typically <2Mb/data "granule", <10Mb/derived product "granule"
- Archive size: ~8.1Tb
- Ingest rate: ~8.25Gb (75K files)/day
- Distribution rate: ~180Gb (~1.7M files)/day
- Data (L1, L1B), products (L2) derived from these data, and information about data and products
- Multi-day, daily, hourly, sub-hourly
- Varying latencies (minutes, hours, days)

Archive Usage:

- The CDDIS contains data and derived products from over 1500 observing sites located at about 1000 locations around the world, going back in time as far as 1975.
- The archive is updated with new data/product files on varying time scales, dependent on the data type, from a sub-daily basis to weekly basis.
- Users require continuous access to data for generation of products on pre-determined schedules.
- The average user of the CDDIS accesses the contents of the archive through anonymous ftp by means of automated scripts executed on predefined schedules (typically sub-daily).
- Analysts can use this method for data transfer because they are familiar with the structure of the online archive and thus know what files they require, their availability schedule, and where to find them within the online structure.

The CDDIS and the IAG

- CDDIS is the principle data center for the geometric supporting services created under the umbrella of the International Association of Geodesy (IAG):
 - International GNSS Service (IGS)
 - International Laser Ranging Service (ILRS)
 - International VLBI Service for Geodesy and Astrometry (IVS)
 - International DORIS Service (IDS)
- These services function as cooperating federations dedicated to a particular type of data (e.g., GNSS, SLR, VLBI, or DORIS)
- The services provide data and products on an operational basis to geodesy analysts as well as a broader scientific community and are examples of a successful model of community management
- Successful operation through cooperation of many international organizations who leverage their respective limited resources to all levels of service functionality
- The CDDIS user community primarily consists of analysts supporting the services within the International Association of Geodesy.
- These groups produce derived products (e.g., positions of observing stations, Earth orientation parameters, precise satellite orbits, etc.) for use by a broader scientific community.
- The CDDIS has extensive partnerships through the IAG serving as one of the primary data centers for the geometric services and its observing system, GGOS (Global Geodetic Observing System)

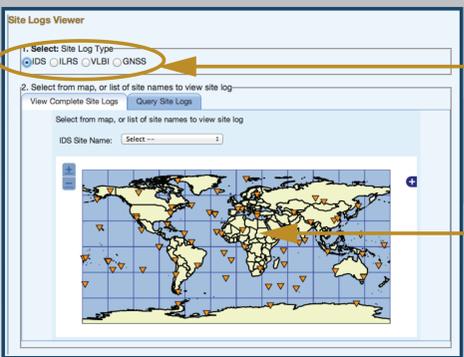
SiteLogViewer Application

Background -- Station Site Logs:

- Each of the IAG's geometric services coordinates measurements from a global network of stations
- Accurate, consistent information about the stations in these networks is vital for data analysis
- Each service has implemented a "site log" that is completed by the station or network operator
- Site logs are formatted ASCII text descriptions of the space geodesy station's location, environment, equipment, co-located instrumentation, and organization/contact information
- Station personnel report changes in the system's configuration, etc. by adding information to the log
- Thus the form serves as a historical collection of major changes during the lifetime of a system's installation
- Each station's site log form is a key source for understanding how the station's configuration has changed over time

Use Cases:

- Users need to query the logs for a particular system to understand station configuration
- Users need to determine which sites have equipment with a particular configuration
- The CDDIS has developed an application, the SiteLogViewer, for the enhanced display and comparison of the contents of these site logs
- Through the SiteLogViewer application, users can:
 - Display a complete site log, section by section
 - Display contents of all site logs for a specified topic (site log section)
 - Search the contents of all site logs for a specified parameter value



The initial page of the SiteLogViewer application displays a list of system types:

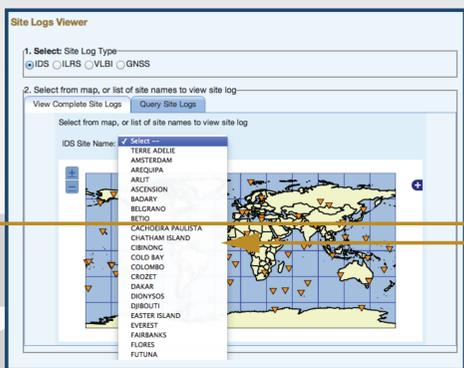
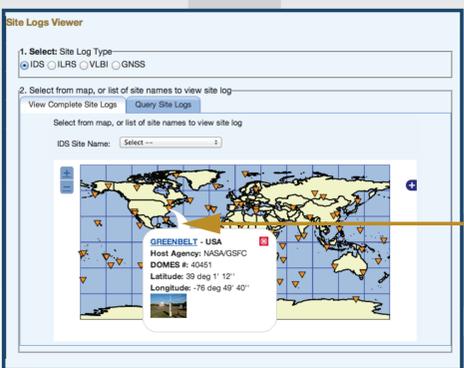
- DORIS site logs (International DORIS Service, IDS)
- SLR site logs (International Laser Ranging Service, ILRS)
- VLBI site logs (International VLBI Service for Geodesy and Astrometry, IVS)
- GNSS site logs (International GNSS Service, IGS)

The user first selects a technique/system type.

Once a technique is selected (e.g., IDS/DORIS) the map is populated with the locations of all DORIS sites.

Two tabs are available:

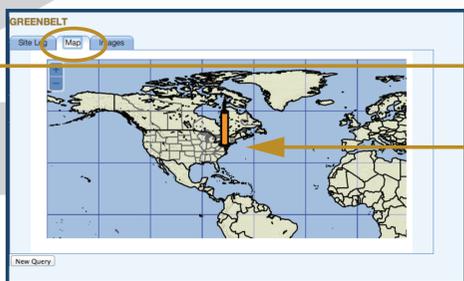
- View Complete Site Logs -- view a full site log (all sections) for one site
- Query Site Logs -- view one section of all site logs; this option also allows the user to search the contents of one section of all site logs for a specified parameter value



When viewing a single site log, the user can select to view the log from a site using one of two methods:

- Clicking a location on the map
- Choosing a site from the drop down list

In this example, the user selects the DORIS station located at Greenbelt MD, USA.



The resulting page shows three tabs

- A list of sections found in the site log on the left, with the contents of the highlighted section on the right.
- A zoom-able map of the selected site's location
- A collection of images of the station and surroundings.

The "New Query" button will allow the user to view another single site log or multiple logs.

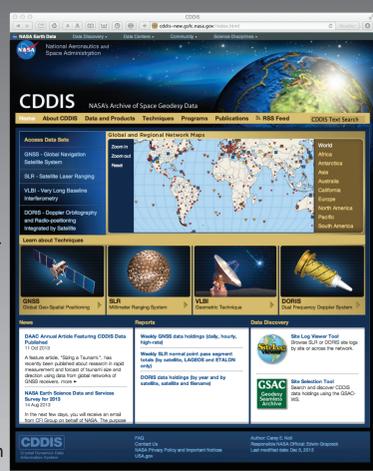
Future Activities

New CDDIS Website:

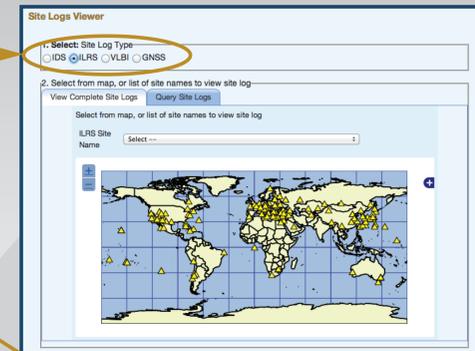
- The CDDIS website has been redesigned and incorporates improved navigation.
- This process has included a content review and update.
- The new website will feature access to the SiteLogViewer application, a map selection tool and the CDDIS data discovery application.
- The data discovery tool is based upon the GSAC-WS, the Geodesy Seamless Archive Center - Web Services, and allows users to search CDDIS metadata to discover CDDIS data, products, and information.
- The new website will also provide links to the EOSDIS EarthData web applications.
- The new CDDIS website will be publicly available in early 2014.

Feedback:

- The staff welcomes feedback on the CDDIS and in particular the ideas expressed in this poster.
- Contact Carey Noll (Carey.Noll@nasa.gov).



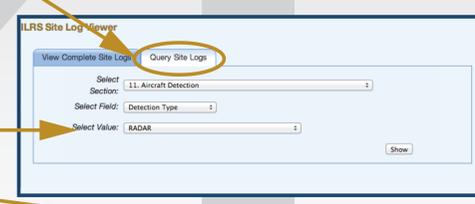
The user returns to the SiteLogViewer home page and selects the ILRS radio button to view site information from the International Laser Ranging Service. A zoom-able map shows all sites in the ILRS network.



The user now wants to determine which sites in the ILRS network have a particular type of equipment installed. To view multiple logs, the user selects the "Query Site Logs" tab. This tab allows the user to select a single section of the site log to:

- View a specified section for all site logs or
- Select a field within a section and specify a value for that field from a drop down menu

In this example, the "Aircraft Detection" section of the ILRS site logs is selected from the drop down list. The user selects "Detection Type" from the list of fields in this section and then selects "RADAR" from the list of possible values for this field.



The results show a table of information extracted from the site log, listing those laser ranging sites using a RADAR for Aircraft Detection. The "Get CSV" button will create a file of these results in comma-separated values format for use in other applications (e.g., Excel).

Site Name	SiteLogFileName	SubsectionNumber	Detection Type
TID0-SLR_Correction (sun)	sun_20100029 (sg)	11.01	RADAR
Deedon (sun)	sun_20121022 (sg)	11.01	RADAR
Taraganine (duff) (gm)	gm_20100113 (sg)	11.01	RADAR
NOLSR (sun)	sun_20100003 (sg)	11.01	RADAR
Geodetic Geophysical Astronomical Observatory (sun)	sun_20100021 (sg)	11.01	RADAR
Hambrook Radio Astronomy Observatory (sun)	sun_20120111 (sg)	11.01	RADAR
Hambrook (sun)	sun_20120112 (sg)	11.01	RADAR
Kagene (sun)	sun_20091021 (sg)	11.01	RADAR
National Observatory of Toulouse (sun)	sun_20120112 (sg)	11.01	RADAR
Mount Peak (sun)	sun_20100326 (sg)	11.01	RADAR
Tell Geodesic Observatory	tel_20120101 (sg)	11.01	RADAR
Wetzel (sun)	sun_20041004 (sg)	11.01	RADAR
Wetzel (sun)	sun_20070722 (sg)	11.01	RADAR

*Note: The official responsibility for receipt and maintenance of each service's logs remains with the service. The CDDIS regularly ingests the logs into a database developed for the SiteLogViewer application. The application also provides a link to the official site log and service to ensure the user has access to the latest information.